Engineering Standard

SAES-M-005 22 May 2013

Design and Construction of Fixed Offshore Platforms

Document Responsibility: Offshore Structures Standards Committee

Saudi Aramco DeskTop Standards

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I Scope

The Standard prescribes minimum mandatory requirements governing the structural design, construction and installation of Saudi Aramco Fixed Offshore template type platforms.

II Conflicts and Deviations

II.A Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAES's), Materials System Specifications (SAMSS's), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

II.B Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure SAEP-302 and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

III References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities required by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

III.A Saudi Aramco References

Saudi Aramco Engineering Procedures

SAEP-120	*Saudi Aramco Security Drawings*
SAEP-302	*Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement*

Saudi Aramco Engineering Standards

SAES-A-112	*Meteorological and Seismic Design Data*
SAES-B-006	*Fireproofing for Plants*
SAES-B-009	*Fire and Safety Requirements for Offshore Production Facilities*
SAES-B-014	*Safety Requirements for Plant and Operations Support Buildings*
SAES-B-054	*Access, Egress and Materials Handling for Plant Facilities*

SAES-B-055	*Plant Layout*
SAES-H-001	*Selection Requirements for Industrial Coatings*
SAES-M-100	*Saudi Aramco Building Code*
SAES-O-201	*Application of Security Directives*
SAES-Q-004	*Installation Specification for Piles of Offshore Structures*
SAES-Q-007	*Foundations and Supporting Structures for Heavy Machinery*
SAES-T-744	*Design Criteria and Installation of Communication Towers*
SAES-W-013	*Welding Requirements for Offshore Structures*
SAES-X-300	*Cathodic Protection of Marine Structures*

Saudi Aramco Materials System Specifications

12-SAMSS-018	*Structural Plates, Rolled Shapes and Tubulars - Specification for Fixed Offshore Platforms*
12-SAMSS-023	*Fiber-Reinforced Plastic (FRP) Grating and FRP Components*

Saudi Aramco Standard Drawings

AA-036248	*Offshore Helideck Types 1 and 2*
AA-036249	*Offshore Helideck Warning Signs*

Saudi Aramco Engineering Reports

SAER-5565	*Red Sea Hindcast Study*
SAER-6406	*Arabian Gulf MetOcean Database 2012*

Saudi Aramco Drafting Manual

Inspection Document

Schedule "Q"	*Quality Assurance and Control, Inspection and Testing*

Note: *For a copy of Schedule "Q" please contact Vendor Inspection Division of Inspection Department.*

III.B Industry Codes and Standards

American Petroleum Institute

API RP 2A	*Planning, Designing and Constructing Fixed Offshore Platforms*
API RP 2L	*Planning, Designing and Constructing Helipads for Fixed Offshore Platforms*

American Institute of Steel Construction

AISC	*Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings*
AISC	*Code of Standard Practice for Steel Buildings and Bridges*

American Society for Testing and Materials

ASTM A123	*Standard Specification for Zinc (Hot-Dip Galvanized) coatings on Iron & Steel Products*
ASTM E515	*Method of Testing for Leaks Using Bubble Emission Technique*

International Maritime Organization Standards

IMO	*Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone*

International Association of Lighthouse Authorities

IALA	*Recommendations for the Marking of Offshore Fixed Structures*
IALA	*Recommendation for the Notation of Luminous Intensity and Range of Lights*
IALA	*Recommendation for the Calculation of the Range of a Sound Signal*
IALA	*Recommendation for a Definition of the Nominal Daytime Range of Maritime Signal Lights Intended for the Guidance of Shipping by Day*
IALA	*Recommendation for Leading Lights*
IALA	*Recommendation for the Colors of Light Signals on Aids to Navigation*

IALA	*Recommendation on the Determination of the Luminous Intensity of a Marine Aid-to-Navigation Light*
IALA	*Recommendation for the Rhythmic Characters of Lights on Aids to Marine Navigation*
IALA	*Recommendation for the Surface Colors Used as Visual Signals on Aids to Navigation (Specifications for Ordinary and Fluorescent Colors)*
IALA	*Recommendation for the Calculation of the Effective Intensity of a Rhythmic Light*

IV Modifications to API RP 2A

The following paragraph numbers refer to API Recommended Practice 2A-WSD (API RP 2A-WSD), "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design", Twenty-first Edition, December, 2000 which is a part of this Standard. The text in each paragraph below is an addition, new section or exception as noted. The 21st edition was used for section (and subsection) identification purposes, and since it is the latest edition at the time of this standard revision. The latest edition of API RP 2A shall be used as stated in Section III above.

1 PLANNING

1.1 General

1.1.1 (Addition) Planning

This Standard provides the minimum structural design and construction requirements which shall be used for steel, fixed offshore platforms.

The design and construction of all newly constructed offshore platforms shall be such that they can be removed in accordance with IMO "Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone."

1.2 Operational Data

1.2.2 (Addition) Location

Details of the offshore platform location and orientation will be provided by Saudi Aramco.

1.2.4 (Addition) Water Depth

A hydrographic survey shall be performed for each platform.
The hydrographic datum shall be Lowest Astronomical Tide (L.A.T).

1.2.5 (Addition) Access and Auxiliary Systems

Security provisions shall be per SAES-O-201.

Means of access for operation and maintenance shall be in accordance with SAES-B-054 and SAES-B-009.

1.2.6 (Addition) Fire Protection

Platform layout shall be in accordance with SAES-B-055.

Fire protection for GOSP complexes and certain tie-in platforms shall be in accordance with SAES-B-006 and SAES-B-009.

1.2.10 (Addition) Personnel and Material Handling

Boat landings and Helidecks shall be in accordance with the following design requirements:

1) Boat Landings

For six to ten well platforms, and tie-in platforms, two "two-level" boat landings shall be provided. Boat landings shall be located on the East and South side of the platform in the Arabian Gulf. Location of boat landings for platforms in the Red Sea shall depend on the prevailing wind direction. For well platforms with less than six wells, one single-level boat landing located on the South side of the platform shall be required. For GOSP and associated platforms at GOSP complexes, boat landings shall be as specified in the project proposal.

All boat landings shall have stair access to upper decks.

All boat landings shall be provided with emergency ladders, bollards and a minimum of two swing ropes. Swing rope arrangement shall be a double-trapeze system attached to the platform by a galvanized chain with the rope end spliced into the chain. Swing rope landing areas shall be free from obstructions such as miscellaneous piping, valves, etc. Emergency man overboard ladders shall be located either inside or to the side of the boat landings.

2) Helidecks

Helideck design criteria shall be submitted to the Manager, Aviation Department, for written concurrence prior to the issuing of project drawings for construction. Minimum helideck design criteria shall be as follows:

a) Helideck shall be designed in accordance with API RP 2L and Standard Drawings AA-036248, Offshore Helideck Types 1, 2 & 3, and AA-036249, Offshore Helideck Warning Signs.

b) Helidecks for GOSP facilities, considered manned facilities, shall be of Type 1 or 2, and at least 24 m (78 ft) across and may be either square or octagonal. Helidecks for unmanned Tie-In and Well platforms shall be of Type 1 or 2. In case this size interferes with marine operations, helidecks for unmanned Tie-In and Well platforms shall be of Type 3, and at least 17 m (55.8 ft) across.

c) All helidecks shall be designed to support (as a minimum) a Bell 214ST. Aviation Department shall be consulted for the maximum size and type of helicopters servicing the platform.

d) Helidecks mounted on the roofs of slab sided buildings shall be raised to provide a minimum air gap of 2 m (6.6 ft).

e) A safety net of minimum 1.5 m (5 ft) wide shall be provided around the perimeter of each helideck. The net shall be 150 mm (6 in) below the deck surface and should have an upward slope of 1:10 to the outside edge.

f) The helideck shall be approachable by air traffic from at least three directions with obstacle free approaches.

g) Any obstacles in the fourth direction shall be at least 6 m (19.7 ft) from the edge of the safety net.

h) Each helideck shall have an access stairway and an emergency escape ladder. Stairways for helidecks on manned platforms shall meet requirements of SAES-B-009.

i) Lighting shall be provided for helidecks at GOSP complexes.

1.3 Environmental Considerations

1.3.1 (Addition) General Meteorological and Oceanographic Considerations

Environmental loads such as wind, wave, tide and current shall be in accordance with SAER-6406 for the Arabian Gulf. Design conditions for

the Red Sea shall be in accordance with SAER-5565.

1.3.7 (Addition) Earthquakes

Seismic forces shall not be considered in the Arabian Gulf. Seismic criteria in other areas of Saudi Arabia shall be according to SAES-A-112, Meteorological and Seismic Design Data standard.

1.3.7e (Addition) Scour

Platform design shall consider the effects of scour. A minimum local scour of 1.50 m (5 ft) shall be used where scourable seabed materials are present.

1.3.8 (Addition) Marine Growth

As a minimum, marine growth of 20 mm (0.75 inch) thickness [40 mm (1.5 inch) on diameter] shall be considered from -6.00 m to +1.20 m L.A.T. (-19.7 ft to + 3.9 ft L.A.T.).

1.4 Site Investigation - Foundations

1.4.1 (Addition) Soil Investigation Objectives

Site Specific geotechnical information is required for all offshore structures at the design stage of the project. The suitability of existing soils data for use in designing new platforms shall be determined by the Manager, Consulting Services Department.

The soil report shall include the following:

- Site plan
- Bore hole logs
- Laboratory test results (triaxial)
- Shear strength profiles
- Unit skin friction profiles
- Unit end bearing profiles
- Axial capacity curves
- Standard Penetration Test
- Piezocone Penetration Test
- Push sampling
- P/y curves
- T-Z, Q-Z analysis
- Site assessment analysis

- Pile Drivability Analysis

Minimum depth to be explored shall be based on the required ultimate static capacity, or, a minimum 75 m (246 ft), whichever is greater.

1.4.2 (Addition) Sea-Bottom Surveys

The type and extent of any sea bottom survey shall be determined at the start of the project.

1.6 Fixed Platforms Types

1.6.3 (Addition) New Concepts - Any new concept (unconventional to Saudi Aramco operations) shall require coordinated review between the various organizations in Saudi Aramco at the study and design stages to ensure adequate engineering review. Additional studies, (such as nonlinear analysis or reserve strength analysis) may be required to examine the reliability of the new concept. All such studies and reviews shall be approved by the manager of Consulting Services Department.

1.10 (Addition) Safety Considerations

1) Obstruction Markings

The design shall provide for marker lights and identification panels in accordance with the "Recommendations for the Marking of Offshore Structures" issued by the International Association of Lighthouse Authorities (IALA).

The following navigational aids shall be installed as a minimum:

Structures having a maximum horizontal dimension of 9 m (3 ft) or less	1 marker light
Structures having a maximum horizontal dimension of over 9 m (30 ft), but not in excess of 15 m (50 ft)	2 marker lights on diagonally opposite corners
Structures having a horizontal dimension of over 15 m (50 ft)	4 marker lights (1 on each corner)

2) Foghorns

Foghorns shall be provided in accordance with "Recommendations for the Marking of Offshore Structures" issued by the International Association of Lighthouse Authorities (IALA), with exceptions and/or modifications as permitted or required by the Kingdom of Saudi

Arabia, Ministry of Communication, Office of the Deputy Minister for Transportation Affairs.

Generally, foghorns shall be placed on selected platforms, near field perimeters. Locations shall be determined after consultation with Marine Department.

3) Riser Protection and Escape Capsule Barrier

Riser protection guards and escape capsule barriers shall be provided where appropriate. These structures shall be designed to sustain some damage as they absorb the energy of impact in extreme conditions.

4) Barge Bumpers

Barge bumpers shall be provided on platform legs at the ends of each boat landing, except on the flare platform, and on the remainder of the outboard platform legs.

However, no barge bumpers shall be provided on the bridge side of platform legs.

2 DESIGN CRITERIA AND PROCEDURES

2.1 General

2.1.2 Definition of Loads

2.1.2c (Addition) Live Loads

The following sections are added to the identical numbered sections in paragraph 2.1.2c.

2) Floor Live Loads

a) Floor Live Loads for Buildings: Floor loads to be considered for the design of buildings shall be as specified in SAES-M-100, Chapter 16, General Design Requirements.

b) Platform Deck Live Loads: shall be as shown in the table below:

	Alternative Live Loads	
	Distributed Load	**Concentrated Load**
Deck Plate and Grating Except Accommodation Platforms and walkways	9.6 kPa (200 lb/ft²)	2224 N (500 lb) Distributed over max. 0.3 x 0.3 m (1 x 1 ft)
Deck Beams: All Platforms except Accommodation Platforms	9.6 kPa (200 lb/ft²)	44482 N (10,000 lb) Distributed over max. 0.91 x 0.91 m (3 x 3 ft)
Deck Beams Plate and Grating on Accommodation Platforms	4.8 kPa (100 lb/ft²)	22241 N (5,000 lb) Distributed over max. 0.91 x 0.91 m (3 x 3 ft)
Walkways for Connecting bridges catwalks, personnel, etc.	2.4 kPa (50 lb/ft²)	2224 N (500 lb) Distributed over max. 0.3 x 0.3 m (1 x 1 ft)

3) Equipment Test Loads

Unless indicated otherwise on hydrostatic test diagrams, all vessels, piping, etc., under hydrotest, shall be assumed completely filled with seawater during testing.

4) Material Handling Loads

a) Helideck Loads: Helideck design loads shall comply with API RP 2L, Section 5, for a 77.8 kN (17500 pounds) as a minimum. Aviation Department shall be consulted for the maximum size and type of helicopters servicing the platform.

b) Marine Vessel Loads: Unless specified in the project design basis, platforms and their boat landings, boat barriers, barge bumpers, mooring systems, etc., shall be designed to absorb berthing energies of maintenance boats, supply boats, etc. For GOSP and all other platforms, the minimum vessel displacement shall be 2000 tons. The approach speed shall be 0.51 m/s (1 knot) at typical vessel approach angles.

c) Mooring Loads: Boat landings, mooring cleats and bollards shall be designed for a pull force of not less than 135 kN (30000 lbs).

6) (Addition) Operating Live Loads

Operating Live Loads are the loads imposed on the platform during its use under normal, day to day operation.

2.1.2d (Addition) Environmental Loads

SAER-6406 shall be used to determine environmental loads for the Arabian Gulf region. Design conditions for the Red Sea shall be in accordance with SAER-5565.

2.1.3 (Addition) Direction of Environmental Loads

The worst combination of wave height, current velocity and wind speed for a given directional sector, as defined in the Arabian Gulf or Red Sea Hindcast studies, shall be used to determine the maximum environmental loads acting on the structure. The design current velocity can be reduced when 1) it can be justified on the basis of a joint probability analysis and 2) it is used in conjunction with the 100 year design storm wave. Joint Extreme Current Speed and Associated Direction are readily available in SAER-6406 for the Arabian Gulf.

2.2 Loading Conditions

2.2.2 (Addition) Design Loading Conditions

The minimum loading combinations are given in the loading combinations table, as shown below:

Loading Combination Table

	Loading Combination		
	A	**B**	**C**
Dead Weights	X	X	X
Live Loads: – Floor – Operating	 X X	 X	
Equip. & Piping Loads: – Operating – Empty	 X	 X	 X
Env. Conditions: – Operating (1 yr storm) – Extreme (100 yr storm)	 X	 X	 X

2.2.3 (Addition) Temporary Loading Conditions

Hydrotesting: For load combination during hydrotesting, the platform structure and foundation shall be checked for a combination of dead loads, appropriate live loads, maximum hydrotest loads, and operating environmental conditions. Appropriate live loads around the equipment for

hydrotest conditions need not be the full specified live loads described in Section 2.1.2c, but should reflect the maximum live loads likely to occur during testing caused by personnel and temporary equipment.

2.2.4 (Addition) Member Loadings

Each deck member shall be designed to support the greater of either the appropriate equipment load combined with the distributed applicable live load as shown in table in Section 2.1.2c or the loads alone as given in the table.

2.3 Design Loads

2.3.1 Waves

2.3.1a (Addition) General

The platform design shall include the use of the maximum wave heights for the 100 year and the 1 year recurrence periods for the extreme and operating design conditions in the appropriate direction, respectively.

2.3.1b (Addition) Static Wave Analysis

2) Wave Force on a Member

Hydrodynamic forces shall be computed from the total kinematics obtained by combining the wave with the total combined effect of wind driven and tidal current.

Account shall be taken of the apparent increased effective diameter of members from marine growth (refer to paragraph 1.3.8) and attached ancillary appurtenances, e.g., sacrificial anodes, pipework for grouting, grout monitoring, installation and fabrication aids, etc.

For riser spacing less than 3.5 * Diameter of the smaller of the two adjacent risers (center to center), solidification effects shall be considered.

2.3.2 Wind

2.3.2a (Addition) General

The platform design shall include the use of the one minute mean wind speeds for the 100 year recurrence period and the one minute mean wind speeds for the 1 year recurrence period for the extreme and operating design conditions, respectively.

Individual components of the deck and facilities including equipment, crane, antenna tower, flare stack, shall be designed using the 3-second gust wind speed for the 100 year extreme condition.

2.3.2b (Addition) Wind Velocity Properties

The wind velocity profile exponents shall be ⅓ for gusts and ⅛ for one minute mean speeds.

2.3.2f (Addition) Shielding Coefficients

No reduction in wind forces calculated in accordance with API RP 2A paragraph 2.3.2c shall be made for the effects of direct shielding afforded by other buildings and structures. Increased wind force on buildings and structures as a result of obstructions shall be accounted for in design.

2.3.2h (New Section) Wind Induced Flutter

Long slender members, such as grout piping and secondary bracing, shall be checked for flutter due to vortex shedding that may occur during fabrication, transportation or in service conditions.

2.3.3 Current

2.3.3a (Addition) General

The current direction specified in SAER-6406 and SAER-5565 is defined as current towards the directional sector of interest; while wind and wave directions are defined as those from the directional sector of interest.

2.4 Fabrication and Installation Forces

2.4.2c (Exception) Dynamic Load Factors

Pad-eyes and internal members connecting directly to the pad-eyes and transmitting lifting forces within the structure during normal installation shall be designed using a minimum load factor of 1.5 applied to the calculated static loads. All other structural members transmitting lifting forces shall be designed using a minimum load factor of 1.15. For lifting frames and for all structures that might be lifted more than once, these factors shall be increased to 2.0 and 1.5.

3 STRUCTURAL STEEL DESIGN

3.1.4 (New Section) Lateral Platform Movement

The design shall assure that no damage will be caused in wellheads or pipe risers due to movement of the platform, or to high or low pressure flare stack due to movement of the flare platform. The maximum differential movement between platforms shall be taken into account when designing connecting bridges and pipework.

3.1.5 (New Section) Connecting Bridge Deflections

Sufficient camber shall be incorporated in the bridge design to eliminate deflections due to dead loads.

4 CONNECTIONS

4.3.1d (New Section) Angle of Intersection

The brace to chord in-plane intersecting angle for primary tubular bracing shall not be less than 30 degrees.

5 FATIGUE DESIGN

5.2.1 (Addition) Seastate Scatter Data

The Seastate scatter data for performing spectral fatigue analysis for the Arabian Gulf and Red Sea shall be provided by the Consulting Services Department.

6 FOUNDATION DESIGN

6.3 Pile Design

6.3.5 (Addition) Alternative Design Methods

The use of any pile design method, not strictly in accordance with API RP 2A, is subject to prior written approval by the Manager, Consulting Services Department.

6.3.7 (New Section) A pile drivability study, approved by the Manager of Consulting Services Department, shall be completed prior to jacket installation. Pile materials shall be selected based on the pile drivability study in addition to design loading conditions.

7 OTHER STRUCTURAL COMPONENTS AND SYSTEMS

7.6 (New Section) Supports for Machinery

7.6.1 Design Requirements

Design of supports for machinery shall be in accordance with SAES-Q-007.

7.6.3 Platform/Machinery Interaction

The influence of platform movement (resulting from environmental conditions and docking vessels) on machinery operations shall be investigated.

7.7 (New Section) Supports for Antenna Towers

7.7.1 Design Requirements

Antenna towers and supports shall comply with the requirements of SAES-T-744 under design environmental conditions. Tower legs shall connect directly to major support framing.

7.8 (New Section) Stacks, Exhaust, etc.

In addition to the strength requirements for static wind loading, stacks, air intakes, and any other intake or exhaust structure shall be designed so that no damage will be caused by dynamic behavior during either sustained wind speeds or 100 years, 3 second gust wind speeds.

Location of air intakes relative to vent stacks shall conform to SAES-B-014.

8 MATERIAL

8.1 Structural Steel

8.1.1 (Addition) General

Steel structural members shall be either Group I or Group II as defined in API RP 2A. Material selection, acceptance criteria, and inspection schedules shall be based on component criticality and severity of service as defined by "service category" designations in Table 8.1 and 12-SAMSS-018.

8.1.4 (Addition) Structural Shape and Plate Specifications.

Structural shapes and plates shall also conform to 12-SAMSS-018.

8.2 Structural Steel Pipe

8.2.1 (Addition) Specifications

Structural steel pipe shall also conform to 12-SAMSS-018.

8.4 Cement Grout and Concrete

8.4.1 (Exception) Cement Grout

If cement grouting of the annulus between pile and jacket leg is required by the design, the grout mix shall have ultimate compressive strength (f'c) = 14 MPa (2000 psi) minimum after 7 days. A 28 day test will not be required.

Grout for load transfer shall be of a non-shrinking or expansive type.

8.5 Corrosion Protection

(Addition) General

The surface area of a platform is divided into four zones for corrosion protection considerations. These zones are:

a) Atmospheric zone.
b) Splash zone.
c) Submerged zone.
d) Below mudline zone.

Protection of structural members in the atmospheric splash zones and submerged zone shall be in accordance with SAES-H-001.

Protection in the submerged zone and the zone below the mudline shall be provided by cathodic protection and shall conform to SAES-X-300.

It is critical that electrical continuity be maintained between the piles and jacket. Continuity must be guaranteed by welding a strap or bar between the pile and jacket.

Table 8.1 – Component Categories and Definitions and Material Classifications

Category	Component	Material Classification	Definition or Example
A	Chord	RT1	Any joint can in a jacket leg (including cans for jacket-to-pile connection), deck leg, or deck column (including cans for major beam connection
	Transition piece	RT2	The pile-to-deck leg transition section.
	Major lifting lugs	PL1	For entire structure or major substructure
	Crane support pedestal	RT2	Any support structure for a permanent heavy crane.
	TKYX joint can on a major brace	RT1	for WT ≥ 25.4 mm (1 in)
		T2	for WT < 25.4 mm (1 in)
	Jacket-to-pile connection pieces	RT1	Crown plate or shims
B	- Jacket leg	RT4	
	- Deck column/leg	RT4	
	- Pile	RT4	
	Major brace	T2/RT2 for stubs onto Cat. A components	A tubular member with a nominal diameter ≥ 12 inches (OD > 12.75 in) (Note 2)
		T3/T4/RT4 for mild section of member	
	Major beam	PL2 for ends onto Cat. A components	A non-tubular member that is either: 1) A plate girder 2) The deepest beam in a major structural unit
		PL4 for mid-section of member	3) Any beam with a nominal depth ≥ 24 inches.
C	Minor brace	T3/T4	A tubular brace with a nominal diameter ≥ 4 inches (OD > 4.5 in) and ≤ 12 inches. (Note 2)
	Minor beam	PL4	Any beam that is not considered major.
	Stiffener rings or diaphragms	PL4	
	Beam stiffeners or gussets or cover plates	PL4	
	Secondary lifting lugs	PL4	
D	Other	PL4/RT4/T4	Any other tubular or structural shape or size not listed above, e.g., deck plate, angle stiffeners, pile guides, grout lines, etc.

Notes:

1) Jacket-to-boatlanding standoffs for other members that are fabricated cone sections shall be considered as braces with a diameter equivalent to the tubular used to fabricate the component.
2) Braces for bridge sections shall be considered major if the nominal diameter > 8 inches.
3) PL refers to Plates
   SH refers to Shapes
   RT refers to Tubulars fabricated from plate
   T refers to Tubulars fabricated from seamless or sub-arc longitudinal welded pipe. Spiral weld pipe is prohibited.

8.6 (New Section) Miscellaneous Structural Materials

8.6.1 Grating

Grating shall be galvanized steel or fiber reinforced plastic per the following:

8.6.1a Steel grating shall be 30 mm x 100 mm (1-3/16 in x 4 in) center-to-center opening size with 6 mm (¼ in) square twisted cross bars. Bearing bar size shall be a minimum of 32 mm x 4.8 mm (1-¼ in x 3/16 in). The steel grating shall be galvanized to conform to ASTM A123 or an approved equivalent.

Exception:

Steel Grating may be coated in accordance with SAES-H-001 when coating systems for offshore grating are specified.

8.6.1b Use of fire-resistant pultruded phenolic material for grating, stair treads, nosing and similar components is acceptable for offshore applications where corrosion significantly shortens the life of steel due to saltwater wash.

Commentary Note:

Examples of such areas are catwalks, stairways, stairway landings, ladders, landing platforms, cellar decks, spider decks, boat landings, lifeboat stations, and access for firefighting equipment on offshore platforms.

Fire-resistant certifications shall be per 12-SAMSS-023 "Fiber-Reinforced Plastic (FRP) Grating and FRP Components". Equivalency of alternatives shall be reviewed and approved by the Chief Fire Prevention Engineer, Loss Prevention Department.

Fire-resistant pultruded phenolic material (grating, stair treads, etc.) shall **not** be used in the following conditions:

1) Inside buildings or other interior enclosed areas.
2) In a fire-hazardous zone as defined in SAES-B-006 and modified by SAES-B-009 for offshore platforms.
3) As a cover for catch basins.
4) As a floor for engines or as part of the engine skid.

The tops of grating, stair treads, nosing, etc., shall be covered with a bonded grit anti-skid surface.

Adequate end support shall be provided where the grating is cut around objects.

8.6.2 Stair Treads

Stair treads shall be of steel grating type with abrasive nosing hot dip galvanized after fabrication per ASTM A123. Stair tread thickness shall be at least 30 mm (1-¼ in) and stair tread width shall be at least 230 mm (9 in). Stair treads for all major stairways shall be at least 750 mm (30 in) long.

Use of fire-resistant pultruded phenolic material for stair treads is acceptable for offshore applications where corrosion significantly shortens the life of steel due to saltwater wash. The same requirements listed in 8.6.1b applies for the use of FRP material in stair treads.

8.6.3 Leg Diaphragm Closures

Where the design requires jacket legs to be closed for installation, jacket leg closures shall be the rubber diaphragm type 60 m (180 ft) minimum water depth rating.

9 DRAWINGS AND SPECIFICATIONS

9.1 (Addition) General

Preparation of the various categories of drawings shall be in accordance with the Contract documents and with Saudi Aramco Drafting Manual.

Master security drawings shall be prepared in accordance with SAEP-120.

10 WELDING

10.1 General

10.1.1 (Addition) Welding shall be done in accordance with SAES-W-013.

10.3 Welding

10.3.10 (New Section) Weld Repairs

Any repair welding shall be done in accordance with SAES-W-013.

10.3.11 (New Section) Finish of Surfaces

When fabrication of various items or portions of a structure is completed, all welds shall be cleaned and smoothed. All burrs and tack welds shall be removed. Marks made by arc strikes shall be ground out and NDE tested. When required, arc strikes shall be ground out, weld repaired, ground smooth and magnetic particle tested again.

10.5 (New Section) Workmanship

10.5.1 Inspection and repair of welded assemblies shall be in accordance with SAES-W-013.

10.5.2 Edges of minor members at joints shall be beveled to give an included angle of 45 degrees if possible. The bevel shall be without a rootface, be feather-edged and with a root opening not less than 2 mm (1/16 in) nor greater than 5 mm (3/16 in). These welds shall be considered partial penetration joints. They shall be welded with as much penetration as possible. The reinforcement of these welds shall be at least equal to the pipe wall thickness of the minor member.

11 FABRICATION

11.1 Assembly

11.1.1 (Addition) General

In addition, fabrication shall be in accordance with AISC "Code of Standard Practice for Steel Buildings and Bridges".

Demountable portions of the structure (such as boat landings) which will be installed offshore shall be trial fitted and match marked onshore to ensure a proper fit.

Where demountable portions of the structure cannot be test fit (e.g., due to inadequate clearances in the yard) they shall be fabricated to the as-built dimensions of the mating guides or supports. Contractor shall demonstrate to Saudi Aramco's satisfaction, that no field (offshore) fit-up problems will be incurred.

11.1.2 Splices

11.1.2a (Addition) Pipe

Segments of pipe of the same diameter may be spliced. The minimum distance between splices shall be 1 m (3 ft) or one diameter, whichever is smaller, unless prior written approval is received from the Manager, Consulting Services Department. There shall be no more than two splices in any ten foot length of pipe. Vertical deck-leg-to-battered- pile transition pieces are exempt from this requirement.

Girth welds in "can" sections to be intersected (or "overlapped") by bracing shall be ground flush in the area of intersection prior to fit-up and welding of the bracing member.

When two sections of pipe to be joined in a butt joint are of different wall thickness, there shall be a smooth transition by beveling the thicker wall pipe. The slope of this transition shall not exceed 25 mm (1 in) thickness change in 100 mm (4 in) along the length of the pipe unless otherwise noted on the Contract drawings.

11.1.5 Final Fabrication Tolerances

11.1.5a (Addition) General

To effectively control fabrication tolerances of structural dimensions, Contractor shall submit a dimensional control report to Company giving at least the overall structural dimensions.

11.1.5b (Addition) Jacket and Deck Section Columns

When shim plates are used for shear transfer between the platform jacket and the piles, the top 600 mm (2 ft) of the longitudinal weld seams inside the jacket legs shall be ground flush to facilitate shim installation in the field.

When crown pieces are used for shear transfer between the platform jacket and the piles, the outside longitudinal weld seams on the first 500 mm (18 in) of the pile exposed above the top of jacket shall be ground flush to facilitate crown installation.

11.1.5f (Addition) Grating

Joints in grating shall occur only at points of support. All grating to be shipped loose for offshore installation shall be marked and identified on the applicable shop drawing.

Grating shall be banded where bar ends are exposed.

11.1.5I (Addition) Piles

The weld seams on the outside of the add-on stabbing guides and the top 3 m (10 ft) of the weld seams on the inside of the main pile sections shall be ground flush to facilitate the stabbing operation.

11.1.5j (New Section) Drilling or Punching Holes

All holes are to be drilled or punched in the structural members prior to sand-blasting and painting.

11.1.6 (Addition) Provisions for Grouted Pile to Sleeve Connection

If grouting of the annulus between pile and jacket leg is specified, each template leg shall be provided with a mechanical grout seal at the bottom to retain the grout. The seals shall be welded to the template legs in accordance with the manufacturer's recommendations.

If grouting of the annulus between pile and jacket leg is not specified, each template leg shall be provided with a welded or screwed 2 inch NB Schedule 80 x 100 mm (4 in) long pipe nipple fitted with a 2 inch NB Schedule 80 screwed cap. The location of each nipple shall be between 1 m (3.3 ft) and 1.5 m (5 ft) above the mudline on the outside of each leg in order to facilitate the placing of a grout plug should grouting become necessary at a future date.

Jacket leg rubber diaphragm assemblies, when required, shall be installed in accordance with the manufacturer's recommendations. All flange welding shall be completed prior to installation of the rubber elements.

See note on corrosion protection (last paragraph in 8.5) to ensure electrical continuity between the pile and jacket.

11.2 Corrosion Protection

11.2.1 (Addition) Coatings

All carbon and alloy steel surfaces shall be coated. Coatings system selection shall be in accordance with SAES-H-001.

11.2.2 (Addition) Splash Zone Protection

When monel is specified, small sheets may be joined and trimmed to the required size to make large sheets. The sheets shall be joined by butt welding. Lap joints are permitted but sheets shall be arranged for maximum flatness.

All welds involving monel shall be leak tested by the liquid application technique of ASTM E515 at 0.035 to 0.070 MPa (5 to 10 psi) to insure a complete seal has been obtained. If leakage is detected, the areas are to be thoroughly cleaned, repair welded and retested.

11.2.3 (Addition) Cathodic Protection

All external metal surfaces, submerged or beneath the mudline, shall be cathodically protected in accordance with SAES-X-300. This includes, but not limited to, piles, jackets, conductors, well casing and structural members.

12 INSTALLATION

12.2 Transportation

12.2.2d (Addition) Load-Out

Contractor shall paint tide gauge markings on template legs or vertical barge bumpers as shown on the drawings. The markings shall be such color to enable them to be seen after sunset. The lowest marking shall be made at the design elevation of -1.0 m L.A.T. and the marks shall be spaced at 0.5 m intervals up to and including +3.0 m. Each stripe shall be numbered accordingly with L.A.T. being shown as 0.0.

12.2.2h (Addition) Buoyancy and Flooding Systems

All flooding valves shall be test operated prior to load out to insure that the valve control rods and the valves operate smoothly and freely, "Stops" shall be provided, to prevent rod and valve from turning through 360 degrees, and limit rotation to 90 degrees (where quarter-turn valves are used). A pointer shall also be provided near the top of the control rod to indicate the open and closed position of the valve. Flooding valve handles shall be checked to insure that handles are properly oriented and are tied in the closed position after testing. Valves shall be checked to insure that protective caps or other obstructions are not present which would prevent proper valve operation.

Jacket legs which are sealed for buoyancy, and buoyancy tanks, shall be (air) pressure tested for closure to 0.07 MPa (10 psig) for two (2) hours with no pressure loss.

12.5 Pile Installation

12.5.1 (Addition) General

Equipment, materials, personnel and procedures for installing offshore structural piles and conductors shall be those described in SAES-Q-004.

13 INSPECTION

13.1 (Addition) General

Contractor Quality Assurance/Quality Control Procedures shall be in accordance with Schedule "Q".

17 ASSESSMENT OF EXISTING PLATFORMS

17.7 (Addition) Structural Analysis for Assessment

The structural analysis assessment procedure shall be approved by the Supervisor of the Civil Engineering Unit of Consulting Services Department.

Revision Summary

22 May 2013	Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with minor revision.